Original Article

The metabolic syndrome in type 2 diabetic subjects in Gorgan, Iran

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Abstract

Objective: To assess the prevalence of the metabolic syndrome in subjects diagnosed with Type 2 diabetes in Gorgan, Iran.

Methods: Data were collected from 200 subjects with Type 2 diabetes mellitus and they were categorized as with or without the metabolic syndrome. Metabolic syndrome was diagnosed using Adult Treatment Panel-III (ATP-III) guidelines.

Results: The overall metabolic syndrome prevalence was 51.50%. The mean age of all the subjects was 53.65±9.50 years. There were 122 females and 78 males of whom 65 females and 38 males had the metabolic syndrome. The mean duration of diabetes was 7.70±1.29 years. Mean triglycerides were 185.15±56.63 mg/dl, and fasting blood glucose 153 ±19.6 mg/dl. These levels were significantly higher in the subjects with type-2 diabetes with metabolic syndrome, but the mean HDL-cholesterol was 37.96±5.09 mg/dl and this was lower ($p< 0.001$). Female and male subjects with metabolic syndrome had significantly longer (except HDL-cholesterol) duration of diabetes, higher Triglyceride, and fasting blood glucose levels ($p < 0.001$, $p < 0.05$).

Conclusion: This study showed a high prevalence of the metabolic syndrome in subjects with type 2 diabetes. Females were more affected than males.

Keywords: Gorgan, Metabolic syndrome, Type 2 diabetes (JPMA 61:458; 2011).

Introduction

Diabetes is a major public health problem that is approaching epidemic proportions globally. This metabolic disease is one of the most common endocrine disorders affecting an almost 6% of the world's population.[1] The prevalence of Type 2 diabetes mellitus ranges from 1.2% to 14.6% in Asia, 4.6% to 40% in the Middle East, and 1.3% to 14.5 % in Iran.[2,3] The number of people affected by Type 2 diabetes is projected to increase sharply from the current estimate of 125 million globally to 221 million by 2010, and to 300 million by 2025.[4] In Asia, the increase in Type 2 diabetes prevalence is even more alarming with the main increase occurring in young adults.[5,6]

The metabolic syndrome (MetS) is described by the clustering of several risk factors for cardiovascular disease (CVD) such as hypertension, dyslipidaemia, obesity (particularly central obesity), insulin resistance and high fasting plasma glucose.[7]

Metabolic syndrome was initially observed in 1923 by Kyln,[8] who described the clustering of hypertension, hyperglycaemia and gout as the syndrome. Subsequently, several other metabolic abnormalities have been associated with this syndrome, including obesity, microalbuminuria, and abnormalities in fibrinolysis and coagulation.[9] In 1988, Gerald Reaven reintroduced the concept of Syndrome X for the clustering of cardiovascular risk factors like hypertension, glucose intolerance, high triglycerides and low high density lipoprotein (HDL) concentration.[10] The syndrome has been given several names, including the 'metabolic syndrome', the 'insulin resistance syndrome', the 'plurimetabolic syndrome', and the 'deadly quartet'.[10] In 1998, world health organization (WHO) proposed a unifying definition for the syndrome and chose to call it the 'metabolic syndrome' rather than the 'insulin resistance syndrome'.[11] This name was selected primarily because it was the cause of all the components of the syndrome.

In 2001, The Third Report of National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) (ATP III) emphasized the importance of the metabolic syndrome and provided a working definition of this syndrome for the first time.[12] Most of the data on metabolic syndromes are based on the studies from Western countries. Differences in genetic background, diet, levels of physical activity, age and sex structure all influence the prevalence of both metabolic syndrome and its components.[13] The prevalence of metabolic syndrome in adult population worldwide varies from 8 to 24.2%[14,15] in males and from 7 to 46.5%[16,17] in females. The importance of the metabolic syndrome in general populations as a predictor of vascular disease has been confirmed by a number of large prospective epidemiologic studies.[18-20] In our area, we do not have enough data on the metabolic syndrome. The present study aimed to

assess the metabolic syndrome in patients diagnosed with Type 2 diabetes in Gorgan (South East of Caspian Sea), Iran.

Subjects and Methods

This study was performed in the Biochemistry and Metabolic Disorder Research Center of Gorgan, Golestan province (South East of Caspian Sea), Iran in 2010. The study group included 200 subjects with type-2 diabetes mellitus who were referred to the Diabetes Center in 5th Azar Hospital, Golestan University of Medical Sciences. All the included subjects provided an informed consent. There were 122 females and 78 males included. At the point of study entry, all study participants were subjected to clinical and biochemical investigations. Data were collected by trained interviewers. The exclusion criterion was the coexistence of any other serious illness. Type-2 diabetes mellitus was defined as nonketosis diabetes by medical history and current treatment with oral hypoglycaemic agents. None of the subjects had micro vascular complications (diabetic nephropathy or retinopathy). Administration of insulin for glycaemic control was considered an exclusion criterion. A venous blood sample was collected from all the subjects who came after a 12-hours overnight fast. The samples were centrifuged for 10 minutes at 3000 rpm. The serum was used for estimating fasting blood glucose, triglycerides and HDL-cholesterol concentration, by biochemical kit using spectrophotometer techniques (Model JENWAY 6105 UV / VIS) in the Biochemistry and Metabolic Disorder Research Center (Faculty of Medicine). Waist circumference was measured at the point halfway between the lower border of ribs and the iliac crest in a horizontal plane . Subjects with Type 2 diabetes were considered to have metabolic syndrome if they had any three or more of the following, according to the ATP III Criteria:[12]

A) Abdominal obesity: WC >102 cm in men and >88 cm in women.

B) Hypertriglyceridaemia: serum triglycerides level ≥ 150 mg/dl (1.69 m mol/l).

C) Low HDL-cholesterol: < 40 mg/dl (1.04 m mol/l) in men and < 50 mg/dl (1.29 m mol/l) in women.

D) High blood pressure: SBP ≥ 130 mmHg and/or DBP ≥ 85 mmHg or on treatment for hypertension.

E) High fasting glucose: serum glucose level ≥ 110 mg/dl (6.1 m mol/l) or on treatment for diabetes.

In subjects with type 2 diabetes, metabolic syndrome was based on the presence of three or more factors (large WC, high fasting glucose, high triglyceride and low HDL-cholesterol) of the metabolic syndrome definition. The results were reported as percentages and mean ± SD. The statistical analysis was done with SPSS- 11.5 version software. The results were evaluated by using student't' test and Chi-squared test. Statistical significance was considered at $P < 0.05$.

Results

A total of two hundred subjects with Type-2 diabetes were studied. The mean age of the subjects was 53.65±9.50 years (range 30-60 years), consisting of 78 (39%) males and 122 (61%) females. The mean duration of diabetes was 5.96±2.20 years.

Table-1 shows the baseline data of the subjects with and without the metabolic syndrome. The mean duration of disease, triglyceride, and fasting blood glucose levels were significantly higher in the Type-2 diabetes with metabolic syndrome, but the mean HDL-cholesterol was lower ($p< 0.001$).

There were no significant differences in the waist circumferences of subjects with type 2 diabetes with or without the metabolic syndrome.

The baseline data of the female and male subjects with and without metabolic syndrome are presented in Table-2. Female and male patients with metabolic syndrome had significantly higher (except HDL-cholesterol) duration of disease, Triglyceride, and fasting blood glucose ($p < 0.001$, $p < 0.05$). There were no significant differences in the waist circumference of subjects with Type 2 diabetes, both male and female, with and without metabolic syndrome.

There were more females than males in the total study population, (122 females' vs.78 males). Female subjects with diabetes had a significantly higher prevalence of the

Table-1: Clinical characteristic of subjects with type 2 diabetes (Total subjects, subjects with and without metabolic syndrome).

Parameters	Total number of subjects with type 2 diabetes	Subjects with Type 2 diabetes & metabolic syndrome	Subjects with Type Type 2 diabetes without metabolic syndrome	P-value
Number of patients (%)	200 (100%)	103(51.50%)	97(39%)	>0.05
Age (years)	53.65±9.50	53.33±9.81	53.98±9.20	>0.05
Duration of diabetes (years)	5.96±2.20	7.70±1.29	4.11±1.26	<0.001
Waist Circumference (cm)(WC>102 for males and WC>88 for females) (%)	145(72.50%)	86(59.31%)	59(40.68%)	>0.05
Triglyceride (mg/dl)	153.94±56.01	185.15±56.63	120.80±30.69	<0.001
HDL-cholesterol (mg/dl)	40.72±5.02	37.96±5.09	43.66±2.79	<0.001
Fasting blood sugar (mg/dl)	131.58±21.78	146.7±19.6	115.74±8.82	<0.001

Table-2: Clinical characteristic of female and males type 2 diabetic subjects (Total subjects, subjects with and without metabolic syndrome).

	Total number of type 2 diabetic patients	Type 2 diabetic with metabolic syndrome	Type 2 diabetic without metabolic syndrome	P-value
Females				
Number of patients (%)	122 (100%)	65 (53.27%)	57 (46.71%)	>0.05
Age (years)	53.74±9.54	53.50±9.80	54.01±9.32	>0.05
Duration of diabetes (years)	6.02±2.16	7.59±1.40	4.22±1.29	0.05>
Waist Circumference (WC>88)(%)	101(82.78%)	60(49.18%)	41(33.60%)	>0.05
Triglyceride (mg/dl)	154.94±54.33	178.69±55.82	127.85±37.63	<0.001
HDL-cholesterol (mg/dl)	40.55±5.41	37.56±5.25	43.96±3.09	<0.001
Fasting blood sugar (mg /dl)	129.96±2.34	145.8±20.88	112.14±8.46	<0.001
Males				
Number of patients (%)	78 (100%)	38 (48.71%)	40 (51.28%)	>0.05
Age (years)	53.95±9.15	53.05±9.94	53.95±9.15	>0.05
Duration of diabetes (years)	3.95±1.21	7.89±1.07	3.95±1.21	<0.001
Waist Circumference (WC>102)(%)	44(56.41%)	26(59.09%)	18(40.90%)	>0.05
Triglyceride (mg/dl)	110.75±10.43	196.21±57.02	110.75±10.43	<0.001
HDL-cholesterol (mg/dl)	43.23±2.28	38.63±4.79	43.23±2.28	<0.05
Fasting blood sugar (mg/dl)	120.78±6.84	148.32±17.46	120.78±6.84	<0.001

metabolic syndrome ($p < 0.001$).

Discussion

The present study aimed to assess the prevalence of the metabolic syndrome in subjects with Type 2 diabetes. Although, many studies have been done to determine the prevalence of diabetes mellitus worldwide and few have been performed to determine the prevalence of metabolic syndrome, but there are no studies on this aspect in this region. People with Type 2 diabetes have a 2-6 times higher risk of death from cardiovascular causes compared to the healthy population.[21] People with the metabolic syndrome are at an increased risk for developing diabetes mellitus and cardiovascular disease, and have a higher mortality from cardiovascular disease. Because the implications of metabolic syndrome for healthcare are substantial, it is essential to establish the prevalence of the metabolic syndrome in all cities of Iran. In our study, there were more female than male participants (122 females, 78 males). This could be due to the high rate of referrals of females with diabetes to Diabetes centers.

The present study showed the prevalence of metabolic syndrome in type 2 diabetes subjects to be 51.50% in Gorgan, which is appreciably higher than many other countries. It was also observed that females (53.27%) were more affected than males (48.71%). The prevalence of metabolic syndrome (using the WHO definition) in Ireland was 21 % with more males (24.6%) than females (17.8%).[15] From the available data from "the Botnia study" (using the WHO definition) and involving families of Finland and Sweden descent, the prevalence was 84% and 78% in male and female subjects with type-2 diabetes, respectively.[9]

In the United States, the prevalence of metabolic syndrome was 21.8% using the ATP III definition.[15] Mexican Americans had the highest prevalence of metabolic syndrome (31.9%). with similar figures for males (24.0%) and females (23.4%).[22] The prevalence in Isfahan (Iran) was 65.0% with a higher rate in females than males (71.7% female and 55.8% male).[23] The prevalence in Karachi (Pakistan) was 79.7% in people with type 2 diabetes, (45.5% females and 34.3% males).[24] The overall prevalence of metabolic syndrome in Japanese subjects with type 2 diabetes was 168 out of 637 (26.37%) persons with type 2 diabetes. The figure was higher in males (45.9%) than females (28.0%).[25] In an another Korean study the estimated overall prevalence was 32.6%. There were 46.9% males and 65.1% females.[26] The overall prevalence among Saudis with type 2 diabetes was 22.64% (19.49% male, 25.17% female).[27] Our results were significantly different from the results of some international studies conducted in different parts of the world. Our figures were lower than those of Isfahan (Iran) and Karachi (Pakistan), but higher than the results of the studies done in Ireland, United States, Mexico, Japan, Korea and Saudi Arabia. Thus our results are in agreement with the studies of Iran and Korea showing metabolic syndrome to be higher in females with type 2 diabetes. The female preponderance could be due to the specific characteristics in the lifestyle changes between females and males with diabetes among the Gorgan inhabitants. Females were less educated in comparison to males and majority of females with the metabolic syndrome were housewives. They were also performing less physical activity at home.

Conclusion

The prevalence of the Metabolic Syndrome according to the ATP111 criteria in Gorgan was high and more so in comparision to other countries. It is therefore advisable that

clinicians should seriously consider screening all obese people regardless of age, for abnormalities in glucose levels. Early treatment in obese people with abnormal glucose level constitutes a strategy of preventing type 2 diabetes mellitus and the metabolic syndrome.

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